BB-1193

TITLE
PLANT AMINOACYL-tRNA SYNTHETASE
ABSTRACT OF THE DISCLOSURE

This invention relates to an isolated nucleic acid fragment encoding an

5   aminoacyl-tRNA synthetase. The invention also relates to the construction of a chimeric gene encoding all or a portion of the aminoacyl-tRNA synthetase, in sense or antisense orientation, wherein expression of the chimeric gene results in production of altered levels of the aminoacyl-tRNA synthetase in a transformed host cell.

10

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WRM/bjm

33

UNITED STATES PATENT AND TRADEMARK OFFICE
DOCUMENT CLASSIFICATION BARCODE SHEET

Sequence Listing

9

Level - 2
Version 1.1

SEQUENCE LISTING

<110>   Falco, S. Carl
         Famodu, Layo O.
         Orozco, Buddy
         Schwaber, James S.

<120>   Plant Aminoacyl-tRNA Synthetase

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<150>   60/093,530
<151>   July 21, 1998

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Leu Ala Pro Phe Thr Pro Phe Leu Thr Asp Asn Ile Tyr Leu Lys Leu
65   70   75   80

Leu Pro His Ile Pro Lys Glu Leu Gln Ser Ala Asp Pro Arg Ser Val
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His Phe Leu Pro Phe Pro Asp Val Arg Glu Glu Leu Phe Asp Glu Glu
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Val Glu Arg Arg Val Gly Arg Met Gln Arg Val Ile Glu Leu Ala Arg
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Val Ser Arg Glu Arg Arg Ala Ile Gly Leu Lys Gln Pro Leu Lys Thr
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Asp Asn Leu Thr Asn Ile Tyr Val Arg Phe Asn Arg Lys Arg Leu Lys
        50   55   60

Gly Arg Ser Gly Glu Glu Asp Cys Arg Ile Ala Leu Ser Thr Leu Tyr
65   70   75   80

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Val Cys Leu Ser Ala Gly Ile Ile Glu Ala Ser Gly Leu Val Val Ala
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Val Asp Asp Asp Gly His Phe Ile Glu Lys Ile Ser Gln Phe Lys Gly
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Arg His Val Lys Glu Ala Asp Lys Asp Ile Ile Asn Ala Val Lys Asp
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Lys Gly Arg Leu Val Ser Lys Gly Ser Ile Glu His Ser Tyr Pro Tyr
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Cys Trp Arg Ser Gly Thr Pro Leu Ile Tyr Arg Ala Val Pro Ser Trp
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Phe Ile Lys Val Glu Lys Ile Arg Asp Gln Leu Leu Glu Cys Asn Lys
            115   120   125

Glu Thr Tyr Trp Val Pro Asp Tyr Val Lys Glu Lys Arg Phe His Asn
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         35                  40                  45

Asn Pro Pro Pro Ala Gly Glu Gly Gly Glu Glu Pro Gln Leu Ser Lys
     50                  55                  60

Asn Ala Lys Lys Arg Glu Glu Lys Arg Lys Lys Leu Glu Glu Glu Arg
 65                  70                  75                  80

Arg Leu Lys Glu Glu Glu Lys Lys Asn Lys Ala Ala Ala Ala Ser Gly
                 85                  90                  95

Lys Pro Gln Lys Ala Ser Ala Ala Asp Asp Asp Asp Met Asp Pro Thr
             100                 105                 110

Gln Tyr Tyr Glu Asn Arg Leu Lys Ala Leu Asp Ser Leu Lys Ala Thr
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Gly Val Asn Pro Tyr Pro His Lys Phe Pro Val Gly Ile Ser Val Pro
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Asp Val Ala Glu Cys Leu Ala Gly Arg Ile Met Asn Lys Arg Thr Ser
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Ser Ser Lys Leu Phe Phe Tyr Asp Leu Tyr Gly Gly Gly Met Lys Val
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Gln Val Met Ala Asp Ala Arg Thr Ser Glu Leu Asp Glu Ala Glu Phe
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Ser Lys Tyr His Ser Gly Val Lys Arg Gly Asp Ile Val Gly Ile Cys
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Thr Arg Ser Lys Ile Val Ser Phe Ile Arg Lys Phe Leu Asp Asp Arg
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Ala Ala Ala Arg Pro Phe Val Thr His His Asn Glu Leu Asn Met Arg
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Leu Phe Met Arg Ile Ala Pro Glu Leu Tyr Leu Lys Glu Leu Val Val
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Gly Gly Leu Asp Arg Val Tyr Glu Ile Gly Lys Gln Phe Arg Asn Glu
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Gly Ile Asp Leu Thr His Asn Pro Glu Phe Thr Thr Cys Glu Phe Tyr
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Pro Phe Arg Arg Ile Asp Met Ile Lys Asp Leu Glu Ala Met Ala Asn
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Cys Val Asn Pro Thr Phe Ile Ile Asn His Pro Glu Ile Met Ser Pro
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Leu Ala Lys Trp His Arg Ser Arg Pro Gly Leu Thr Glu Arg Phe Glu
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Leu Phe Val Asn Lys His Glu Val Cys Asn Ala Tyr Thr Glu Leu Asn
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Gln Ser Gly Asp Asp Glu Ala Met Ala Leu Asp Glu Thr Phe Cys Thr
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Gly Gly Leu Asp Arg Val Tyr Glu Ile Gly Lys Gln Phe Arg Asn Glu
        50   55   60

Gly Ile Asp Leu Thr His Asn Pro Glu Phe Thr Thr Cys Glu Phe Tyr
65   70   75   80

Met Ala Tyr Ala Asp Tyr Asn Asp Leu Ile Glu Leu Thr Glu Thr Met
                85   90   95

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9

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Leu Lys Tyr Leu Ala Val Gln Lys Ala Glu Gly Asn Asn Pro Tyr Pro
                85                  90                  95

His Lys Phe Phe Val Thr Met Ser Leu Asp Gln Tyr Ile Lys Glu Tyr
                100                 105                 110

Gly Gly Leu Ser Asn Gly Gln His Leu Glu Asp Val Ser Val Ser Met
            115                 120                 125

Ala Gly Arg Ile Met His Lys Arg Thr Ser Gly Ser Lys Leu Val Phe
        130                 135                 140

Tyr Asp Leu His Ser Gly Gly Phe Lys Val Gln Val Met Ala Asp Ala
145                 150                 155                 160

Ser Lys Ser Asp Leu Asp Glu Ala Glu Phe Ser Lys Phe His Ser Asn
                165                 170                 175

Val Lys Arg Gly Asp Ile Val Gly Ile Thr Gly Phe Pro Gly Lys Ser
            180                 185                 190
```

10

Lys Lys Gly Glu Leu Ser Ile Phe Pro Lys Thr Phe Val Leu Leu Ser
        195   200   205

His Cys Leu His Met Met Pro Arg Gln Lys Ser Ala Ala Ala Ala Asp
    210   215   220

Asn Ala Asn Leu Lys Lys Asn Pro Trp Val Pro Gly Ser Thr Arg Asn
225   230   235   240

Pro Glu Thr Tyr Ile Leu Lys Asp Gln Glu Thr Arg Tyr Arg Arg His
            245   250   255

Leu Asp Leu Met Leu Asn Pro Glu Val Arg Glu Ile Phe Lys Thr Arg
            260   265   270

Ser Lys Ile Ile Cys Tyr Ile Arg Arg Phe Leu Asp Asp Leu Asp Phe
    275   280   285

Leu Glu Val Glu Thr Pro Met Met Asn Met Ile Ala Gly Gly Ala Ala
    290   295   300

Ala Arg Pro Phe Val Thr His His Asn Asp Leu Asn Met Arg Leu Phe
305   310   315   320

Met Arg Ile Ala Pro Glu Leu Tyr Leu Lys Glu Leu Val Val Gly Gly
            325   330   335

Leu Asp Arg Val Tyr Glu Ile Gly Lys Gln Phe Arg Asn Glu Gly Ile
            340   345   350

Asp Leu Thr His Asn Pro Glu Phe Thr Thr Cys Glu Phe Tyr Met Ala
    355   360   365

Tyr Lys Asp Tyr Asn Asp Leu Met Asp Ile Thr Glu Gln Met Leu Ser
    370   375   380

Gly Met Val Lys Glu Leu Thr Xaa Xaa Xaa Tyr Lys Ile Lys Tyr His
385   390   395   400

Ala Asp Gly Ile Asp Lys Glu Pro Ile Glu Ile Asp Phe Thr Pro Pro
            405   410   415

Phe Arg Arg Ile Asp Met Ile Asp Glu Leu Glu Lys Val Ala Gly Leu
            420   425   430

Ser Ile Pro Lys Asp Leu Ser Ser Glu Glu Ala Asn Gln Tyr Leu Lys
            435   440   445

Asp Thr Cys Leu Lys Tyr Glu Ile Lys Cys Pro Pro Pro Glu Thr Thr
    450   455   460

Ala Arg Leu Leu Asp Lys Leu Val Gly His Phe Leu Glu Glu Thr Cys
465   470   475   480

Val Asn Pro Thr Phe Ile Ile Asn His Pro Glu Ile Met Ser Pro Leu
            485   490   495

Ala Lys Trp His Arg Ser Lys Arg Gly Leu Thr Glu Arg Phe Glu Leu
            500   505   510

11

```
Phe Val Asn Lys His Glu Leu Cys Asn Ala Tyr Thr Glu Leu Asn Asp
        515                 520                 525

Pro Val Val Gln Arg Gln Arg Phe Ala Glu Gln Leu Lys Asp Arg Gln
        530                 535                 540

Ser Gly Asp Asp Glu Ala Met Ala Phe Asp Glu Thr Phe Cys Thr Ala
545                 550                 555                 560

Leu Glu Tyr Gly Leu Pro Pro Thr Gly Gly Trp Gly Leu Gly Ile Asp
                565                 570                 575

Arg Leu Thr Met Leu Leu Thr Asp Ser Gln Asn Ile Lys Glu Val Leu
                580                 585                 590

Leu Phe Pro Ala Met Lys Pro
        595
```

```
<210>   15
<211>   702
<212>   DNA
<213>   Triticum aestivum

<400>   15
gcacgaggct tgacaagcta gtgggccatt tcttggagga aacatgtgtg aacccaacat   60
ttattatcaa ccacccagag ataatgagtc cattggcaaa gtggcatagg tcccgacctg  120
ggttgacaga aaggtttgag ctctttgtta acaaacacga ggtgtgcaat gcctacactg  180
agttgaacga tcctgttgtg caaaggcaac ggtttgagga acaactaaag gatcgtcaat  240
ctggtgatga tgaagctatg gctttggacg aaacattctg cactgccctc gagtatgggc  300
tgcctccgac aggtggttgg ggtttgggaa ttgatcgcct tacaatgatg ctgacagatt  360
cccagaacat caaggaagtt ctcttgttcc cggccatgaa gccccaagag tagctgtttg  420
caagcccatc aacagagtaa ttttgttttg ctgcgctgag gttggaggat tatgacatgt  480
gacaatacaa cgagttttaa ctgtgccgga caaaacatgt gtagcagcac tggaggtaca  540
agctactttt gcgtggaagg gttgttgaaa atttgaactc cggttaggag gaagagtgag  600
gcatatgaag caagaatcag aaggagacag tgtgctacat gtttgcttgt tttctttttg  660
gaagatcaaa atttagtgct tggtattgtt atacactttt tt                     702
```

```
<210>   16
<211>   136
<212>   PRT
<213>   Triticum aestivum

<400>   16
```
```
Thr Arg Leu Asp Lys Leu Val Gly His Phe Leu Glu Glu Thr Cys Val
  1                 5                  10                 15

Asn Pro Thr Phe Ile Ile Asn His Pro Glu Ile Met Ser Pro Leu Ala
                20                 25                 30

Lys Trp His Arg Ser Arg Pro Gly Leu Thr Glu Arg Phe Glu Leu Phe
            35                 40                 45

Val Asn Lys His Glu Val Cys Asn Ala Tyr Thr Glu Leu Asn Asp Pro
    50                 55                 60

Val Val Gln Arg Gln Arg Phe Glu Glu Gln Leu Lys Asp Arg Gln Ser
65                 70                 75                 80

Gly Asp Asp Glu Ala Met Ala Leu Asp Glu Thr Phe Cys Thr Ala Leu
                85                 90                 95
```

12

```
Glu Tyr Gly Leu Pro Pro Thr Gly Gly Trp Gly Leu Gly Ile Asp Arg
            100             105             110

Leu Thr Met Met Leu Thr Asp Ser Gln Asn Ile Lys Glu Val Leu Leu
            115             120             125

Phe Pro Ala Met Lys Pro Gln Glu
        130             135
```

```
<210>   17
<211>   1430
<212>   DNA
<213>   Zea mays
```

```
<400>   17
cgaaccgctc gctgctggct cctccgcgcg cgtgttcgcg gcatggccac gcttccaatg    60
gcgctctccc ccgccgccat ttcccccttc accaccctcc ccctctacta ttcttcgcgt   120
cctcaccgcc gcctcctcgc ccgcttcttc tccgtcgctt cggcaccggg cggagcgaaa   180
gggcaccgac cggcggcctc cgccgttgag gtgggcggcg tcaagatcgc gcgcgaggat   240
gttgtgaagg aggatgatcc gacaaacaac gtgcccgaca atatcttttc gaagatcggc   300
ctgcagctgc acaggaggga taaccatccc cttgggattt tgaagaacac aatttatgat   360
tactttgaca agaacttcac tgggcagttt gacaagtttg atgacctttg ccctcttgtt   420
tctgtcaagc agaattttga tgatgtcttg gtcccttctg accatgtaag ccggagttac   480
aacgacacat attatgttga tggtcaaaca gtcttaaggt gtcataccag tgctcatcaa   540
gctgagctgc taaggcatgg acatacacac tttcttgtaa ctggagatgt ttaccgtagg   600
gattccattg attcaactca ctatcctgtc ttccatcaga tggaagggtt ccgtgtcttc   660
tctcctgatg aatggtcagg gtctcgcatg ggtgggacag catatgcagc tgcagaactc   720
aagaaaacac tggaaggctt ggcaagacat ctatttggtg ctgtagagat gcgatgggtt   780
gacacttact tcccatttac caacccatcc tttgagctcg aaatatactt tcaggatgat   840
tggttggagg ttttgggggtg tggagtcacc gagcaggaaa ttttgaaaag aaatggcagg   900
agggaccatg tggcatgggc ctttggattg ggcttggagc gccttgcaat ggtccttttc   960
gacattccag atattcgact attctggtcg aatgataaac ggttcacgtc ccagttctca  1020
gaaggcaagc ttggtgtcaa gttcaagcca ttttcaaagt ttcctccttg ttacaaggat  1080
atgagtttct ggatcaatga tgcatttaca gaaaacaact tatgtgaggt tgtcagagga  1140
attgctggtg atcttgttga ggaggtaaaa cttattgata atttcacgaa caagaaaggc  1200
atgacgagcc attgctatag aatagcctat aggtcgatgg aacgctcgct cacagacgag  1260
gagattaaca atcttcagtt gaatgtcagg gaagctgtga aagataaatt ggaagtagag  1320
ttgagataga agcagctagc tatgcagtta taccatgaac taaattttgc ctctctttat  1380
atgtaaatcc atttaaaatg atttttttgt atctatcaag aaaatgcacc              1430
```

```
<210>   18
<211>   442
<212>   PRT
<213>   Zea mays
```

```
<400>   18
Arg Thr Ala Arg Cys Trp Leu Leu Arg Ala Arg Val Arg Gly Met Ala
  1               5              10                  15

Thr Leu Pro Met Ala Leu Ser Pro Ala Ala Ile Ser Pro Phe Thr Thr
            20              25                  30

Leu Pro Leu Tyr Tyr Ser Ser Arg Pro His Arg Arg Leu Leu Ala Arg
        35              40                  45

Phe Phe Ser Val Ala Ser Ala Pro Gly Gly Ala Lys Gly His Arg Pro
    50              55                  60
```

13

```
Ala Ala Ser Ala Val Glu Val Gly Gly Val Lys Ile Ala Arg Glu Asp
65              70              75                      80

Val Val Lys Glu Asp Asp Pro Thr Asn Asn Val Pro Asp Asn Ile Phe
            85              90                      95

Ser Lys Ile Gly Leu Gln Leu His Arg Arg Asp Asn His Pro Leu Gly
            100             105             110

Ile Leu Lys Asn Thr Ile Tyr Asp Tyr Phe Asp Lys Asn Phe Thr Gly
            115             120             125

Gln Phe Asp Lys Phe Asp Asp Leu Cys Pro Leu Val Ser Val Lys Gln
    130             135             140

Asn Phe Asp Asp Val Leu Val Pro Ser Asp His Val Ser Arg Ser Tyr
145             150             155             160

Asn Asp Thr Tyr Tyr Val Asp Gly Gln Thr Val Leu Arg Cys His Thr
            165             170             175

Ser Ala His Gln Ala Glu Leu Leu Arg His Gly His Thr His Phe Leu
            180             185             190

Val Thr Gly Asp Val Tyr Arg Arg Asp Ser Ile Asp Ser Thr His Tyr
            195             200             205

Pro Val Phe His Gln Met Glu Gly Phe Arg Val Phe Ser Pro Asp Glu
    210             215             220

Trp Ser Gly Ser Arg Met Gly Gly Thr Ala Tyr Ala Ala Ala Glu Leu
225             230             235             240

Lys Lys Thr Leu Glu Gly Leu Ala Arg His Leu Phe Gly Ala Val Glu
            245             250             255

Met Arg Trp Val Asp Thr Tyr Phe Pro Phe Thr Asn Pro Ser Phe Glu
            260             265             270

Leu Glu Ile Tyr Phe Gln Asp Asp Trp Leu Glu Val Leu Gly Cys Gly
            275             280             285

Val Thr Glu Gln Glu Ile Leu Lys Arg Asn Gly Arg Arg Asp His Val
    290             295             300

Ala Trp Ala Phe Gly Leu Gly Leu Glu Arg Leu Ala Met Val Leu Phe
305             310             315             320

Asp Ile Pro Asp Ile Arg Leu Phe Trp Ser Asn Asp Lys Arg Phe Thr
            325             330             335

Ser Gln Phe Ser Glu Gly Lys Leu Gly Val Lys Phe Lys Pro Phe Ser
            340             345             350

Lys Phe Pro Pro Cys Tyr Lys Asp Met Ser Phe Trp Ile Asn Asp Ala
    355             360             365

Phe Thr Glu Asn Asn Leu Cys Glu Val Val Arg Gly Ile Ala Gly Asp
    370             375             380
```

14

Leu Val Glu Glu Val Lys Leu Ile Asp Asn Phe Thr Asn Lys Lys Gly
385   390   395   400

Met Thr Ser His Cys Tyr Arg Ile Ala Tyr Arg Ser Met Glu Arg Ser
                405   410   415

Leu Thr Asp Glu Glu Ile Asn Asn Leu Gln Leu Asn Val Arg Glu Ala
            420   425   430

Val Lys Asp Lys Leu Glu Val Glu Leu Arg
        435   440

<210> 19
<211> 1000
<212> DNA
<213> Oryza sativa

<400> 19
gcacgagtgg taccaacagc atcctgctcg ggattcacac gatacatttt ttcttgaagc   60
ccctgccgct acaaaacaat tgcctgaaga ttatcttgag aaagtaaagg aagttcatca   120
acgtggtggt tatggctcca agggatatgg ctatgactgg aaacgggatg aagcagagaa   180
aaacctgctt cgtacccaca ctacagcagt ttcaacaagg atgctataca agctagcaca   240
agagaaacct tttgccccta agaggtacta ctccattgat cgtgttttcc gcaatgaagc   300
tgtggaccgg actcatcttg cggaattcca ccagattgaa ggtctcattt gtgattatgg   360
tttgacgctg ggtgatctga ttggtgtatt ggaggatttc ttctcgagtc taggcatgtc   420
aaagctgcgt ttcaagcctg cctacaatcc atacaccgag ccgagcatgg aaattttcag   480
ttaccatgaa ggtttgaaga aatgggtgga agttggtaac tctggcatgt tcagacctga   540
aatgttactt cccatgggac tgccagaggg tgttaatgtt attgcatggg gtctttcact   600
agaaaggcca acaatgattc tttacggcat cgacaacatt cgagacctct ttggaccaaa   660
ggttgatttc aacctcatca agagcaaccc tctctgccgc ttgggactgc agtaaaacct   720
tgcaaaagtt ggttggaagt gattaagtaa caagatttgt ttagttgatc agtggttgaa   780
cgtgaagaga tcatttctgg cttaccttga aacaccaata catgtgcatt tagcagaggt   840
ttttgtatta cagttttgag tgatatgaga ctaccagcca attttgtgt gtgtccatat   900
tcgaatactt tgatacattt taattgagca catccaatgt atgaagtggt catctgccgc   960
tgcggttgct tgaatcaaaa aaaaaaaaaa aaaaaaaaaa   1000

<210> 20
<211> 237
<212> PRT
<213> Oryza sativa

<400> 20
His Glu Trp Tyr Gln Gln His Pro Ala Arg Asp Ser His Asp Thr Phe
1   5   10   15

Phe Leu Glu Ala Pro Ala Ala Thr Lys Gln Leu Pro Glu Asp Tyr Leu
            20   25   30

Glu Lys Val Lys Glu Val His Gln Arg Gly Gly Tyr Gly Ser Lys Gly
        35   40   45

Tyr Gly Tyr Asp Trp Lys Arg Asp Glu Ala Glu Lys Asn Leu Leu Arg
    50   55   60

Thr His Thr Thr Ala Val Ser Thr Arg Met Leu Tyr Lys Leu Ala Gln
65   70   75   80

Glu Lys Pro Phe Ala Pro Lys Arg Tyr Tyr Ser Ile Asp Arg Val Phe
            85   90   95

15

```
Arg Asn Glu Ala Val Asp Arg Thr His Leu Ala Glu Phe His Gln Ile
            100                 105                 110

Glu Gly Leu Ile Cys Asp Tyr Gly Leu Thr Leu Gly Asp Leu Ile Gly
            115                 120                 125

Val Leu Glu Asp Phe Phe Ser Ser Leu Gly Met Ser Lys Leu Arg Phe
    130                 135                 140

Lys Pro Ala Tyr Asn Pro Tyr Thr Glu Pro Ser Met Glu Ile Phe Ser
145                 150                 155                 160

Tyr His Glu Gly Leu Lys Lys Trp Val Glu Val Gly Asn Ser Gly Met
                165                 170                 175

Phe Arg Pro Glu Met Leu Leu Pro Met Gly Leu Pro Glu Gly Val Asn
            180                 185                 190

Val Ile Ala Trp Gly Leu Ser Leu Glu Arg Pro Thr Met Ile Leu Tyr
            195                 200                 205

Gly Ile Asp Asn Ile Arg Asp Leu Phe Gly Pro Lys Val Asp Phe Asn
    210                 215                 220

Leu Ile Lys Ser Asn Pro Leu Cys Arg Leu Gly Leu Gln
225                 230                 235

<210>  21
<211>  387
<212>  DNA
<213>  Glycine max

<220>
<221>  unsure
<222>  (337)

<220>
<221>  unsure
<222>  (379)

<400>  21
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catgggtgtc cctccaaatg gtggccatct tcacacttta cttaaatgca gaactatgat 120
gaaagaaatc ttcttggaaa tgggatttga agaaatgcca accaacaatt acgttgaatc 180
ttctttctgg aattttgata ctttatttca acctcaacaa catcctgctc gtgatgctca 240
cgatactttc ttcctttctg aacctgcatc tgccaaatcc attccacaag attatttaga 300
aagagtgaaa acaatgcatg agaaaggagg gcacggntct attggttgga gatacgactg 360
gagtggaaac tgagtccana aaaaaaa                                     387

<210>  22
<211>  123
<212>  PRT
<213>  Glycine max

<400>  22
Ile Ala Asn Gly Ser Trp Lys Glu Lys Ser Phe Lys Ser Leu Asn Leu
  1               5                  10                  15

Gly Lys Gly Val Met Gly Val Pro Pro Asn Gly Gly His Leu His Thr
            20                  25                  30
```

16

```
Leu Leu Lys Cys Arg Thr Met Met Lys Glu Ile Phe Leu Glu Met Gly
        35                  40                  45

Phe Glu Glu Met Pro Thr Asn Asn Tyr Val Glu Ser Ser Phe Trp Asn
        50                  55                  60

Phe Asp Thr Leu Phe Gln Pro Gln Gln His Pro Ala Arg Asp Ala His
65                  70                  75                  80

Asp Thr Phe Phe Leu Ser Glu Pro Ala Ser Ala Lys Ser Ile Pro Gln
                85                  90                  95

Asp Tyr Leu Glu Arg Val Lys Thr Met His Glu Lys Gly Gly His Gly
            100                 105                 110

Ser Ile Gly Trp Arg Tyr Asp Trp Ser Gly Asn
        115                 120
```

<210> 23
<211> 1074
<212> DNA
<213> Triticum aestivum

<400> 23
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gcacgaggga caacctattg cgataggata tagccaaccg ttgttagagg tccgtgaggc   60
aatccagaac attttctcg agatggggtt cagtgagatg ccaacgaaca tgtatgtaga  120
gagcagcttc tggaattttg atgcactgtt ccagccacaa cagcatcctg ctcgtgattc  180
acacgatacc ttttcctca aagcccctgc tacaacaaca caattacctg atgactatct  240
tgagaaagta aagcaagtac atcagtctgg tggtcatggc tccaaaggat atggttacga  300
ttggaagcga gatgaagcag agaaaaacct gcttcgtact cacacaactg cagtttcaac  360
aaggatgcta tacaagctag cacaggagaa aacttttgct cctaagagat actattctat  420
tgatcgtgtt ttccggaatg aagctgtgga ccgaactcat cttgcagaat ccaccagat  480
agaaggtctt atttgtgatt atggtttgac gcttggtgat ctgataggtg tattggagga  540
tttcttctcc agactaggca tgtcaaagct gcgtttcaaa cctgcctaca acccgtacac  600
tgaaccaagc atggaaattt tcagctacca cgatggtctg aagaaatggg tggaaatagg  660
caactcaggc atgttcaggc cggaaatgtt acttcccatg ggactgccag agggtgttaa  720
tgttatcgca tggggtcttt cgcttgaaag gccaacaatg attctgtatg ggattgacaa  780
catacgtgat ctctttgggc caaaggtcga cttcaatctg atcaagagca gcccgatttg  840
ccgcttgggg ctgtagtgtg gtgagcttga tagaactta tctggatgtc tggatgcgaa  900
ggatgtttat ttgtggttat acctttgaaa accagtactt gtgcatttaa cagaggagt  960
gcagaaatac acacatgtag ctctgaattg caaaaaaaaa aaaaaaaaaa aaaaaaaaa 1020
aataaaaaaa aaacaaaaaa aaaaaaaaaa tactcgaggg ggggccgtac caca      1074
```

<210> 24
<211> 284
<212> PRT
<213> Triticum aestivum

<400> 24
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His Glu Gly Gln Pro Ile Ala Ile Gly Tyr Ser Gln Pro Leu Leu Glu
 1               5                  10                  15

Val Arg Glu Ala Ile Gln Asn Ile Phe Leu Glu Met Gly Phe Ser Glu
            20                  25                  30

Met Pro Thr Asn Met Tyr Val Glu Ser Ser Phe Trp Asn Phe Asp Ala
        35                  40                  45
```

17

```
Leu Phe Gln Pro Gln Gln His Pro Ala Arg Asp Ser His Asp Thr Phe
    50                  55                  60

Phe Leu Lys Ala Pro Ala Thr Thr Thr Gln Leu Pro Asp Asp Tyr Leu
65                  70                  75                  80

Glu Lys Val Lys Gln Val His Gln Ser Gly Gly His Gly Ser Lys Gly
                85                  90                  95

Tyr Gly Tyr Asp Trp Lys Arg Asp Glu Ala Glu Lys Asn Leu Leu Arg
            100                 105                 110

Thr His Thr Thr Ala Val Ser Thr Arg Met Leu Tyr Lys Leu Ala Gln
        115                 120                 125

Glu Lys Thr Phe Ala Pro Lys Arg Tyr Tyr Ser Ile Asp Arg Val Phe
    130                 135                 140

Arg Asn Glu Ala Val Asp Arg Thr His Leu Ala Glu Phe His Gln Ile
145                 150                 155                 160

Glu Gly Leu Ile Cys Asp Tyr Gly Leu Thr Leu Gly Asp Leu Ile Gly
            165                 170                 175

Val Leu Glu Asp Phe Phe Ser Arg Leu Gly Met Ser Lys Leu Arg Phe
            180                 185                 190

Lys Pro Ala Tyr Asn Pro Tyr Thr Glu Pro Ser Met Glu Ile Phe Ser
            195                 200                 205

Tyr His Asp Gly Leu Lys Lys Trp Val Glu Ile Gly Asn Ser Gly Met
    210                 215                 220

Phe Arg Pro Glu Met Leu Leu Pro Met Gly Leu Pro Glu Gly Val Asn
225                 230                 235                 240

Val Ile Ala Trp Gly Leu Ser Leu Glu Arg Pro Thr Met Ile Leu Tyr
            245                 250                 255

Gly Ile Asp Asn Ile Arg Asp Leu Phe Gly Pro Lys Val Asp Phe Asn
            260                 265                 270

Leu Ile Lys Ser Ser Pro Ile Cys Arg Leu Gly Leu
        275                 280
```

<210> 25
<211> 1939
<212> DNA
<213> Zea mays

<400> 25
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gtccggaatt cccgggtcga cccacgcgtc cgtgctgtcc cattggcaac ttgcgcgcta   60
ctctgactcg agtggccgct actctacccc acccacaccc ttccgcccgc cgccactaaa  120
ccctagcggg acacccgcct tgctcgcgcc gcctcatcct ctcactcctc tcggaccccc  180
ggtggccggt gcagagctgc gcgaccgaga accgaatctg tgagccatgt cgaccaacaa  240
gggcagcgcg gccaagggcg gcggagggaa gaagaaggag gtgaagaagg agacgaagct  300
cgggatggcc tataagaagg acgacaactt cggggagtgg tactccgagg ttgttgttaa  360
cagtgaaatg attgagtact atgacatttc tggttgttat atattgaggc catgggcgat  420
ggaaatctgg gagctactga aagaattctt tgatgcagaa attaaaaagc tgaagctcaa  480
accatattat ttcccttgt ttgttactga gaatgttcta cagaaggaaa aggaccacat  540
```

18

```
       tgagggcttt gcacctgagg tagcttgggt tactaaatct gggaaatctg acctggaagc  600
       accgattgca atccgcccca caagtgagac tgtcatgtat ccgtacttct ccaaatggat  660
       aagaagccac cgagacttac ccttgaggtg taatcaatgg tgtaatgttg ttagatggga  720
       gtttagcaat ccaactcctt tcataaggag ccgtgaattt ctgtggcaag aggggcatac  780
       tgcttttgcg actaaagaag aggcagatga agaggttctc caaatattgg aactgtaccg  840
       aaggatatac gaagaatttt tagcagttcc agtttccaaa gggagaaaaa gcgagatgga  900
       aaaatttgca ggtggccttt ataccaccag cgttgaggcc ttcattccaa cactggtcg   960
       tggcatacaa ggcgcaacct cacactgtct tggtcaaaac tttgccaaga tgtttgatat 1020
       cacttttgag aatgagaaag gtgttaggga aatggtttgg caaaactctt gggcctacac 1080
       aacccgctcg attggagtga tggtgatgac acatggtgat gacaaaggct tagtattacc 1140
       accaaaggtg gcaccaatcc aggtaatcgt gatttcagtg ccttataagg acgctgacac 1200
       aactgccata aagggagcct gcgaatcaac tgtttacaca ctcgatcaat ctgggattag 1260
       agcggatcag gacacccgtg aaaattactc tccaggttgg aagtattccc actgggaaat 1320
       gaaaggtgtt ccattgagaa ttgagattgg tccaaaagat ctggcaaaca aacaggtgcg 1380
       tgttgtccgc cgggacaacg gtgcaaaggt tgacatccct gtgaccaatt ggttgaaga  1440
       ggttaaagtg ttactggatg agattcaaaa aaatctgttc aaaacagccc aagaaaagag 1500
       agatgcctgt gttcatgtcg tgaacacttg ggatgaattc acaactgctc tgaataacaa 1560
       aaagttgatc ttggctccat ggtgtgatga ggaggaaatt gagaaagatg taaaaactcg 1620
       gacaaaaggg gaacttggag ctgcgaaaac attgtgtact ccatttgagc agccagaact 1680
       tccagaaggt accctgtgct ttgcatctgg aaagccagcg aagaagtggt cgttctgggg 1740
       ccgcagctac tgattgcctg tgctgggatt atttctggat tcagttctag tgagttatgt 1800
       agctttgaag tgtcggatac aaatccaaaa atccatttac attgcgtttt acatcgactt 1860
       gcagttctca tgtcatcact gctgacaaaa gccatcgatt tcctgtggac catgctattc 1920
       gagtttgaat gttgcaagg                                             1939
```

<210>   26
<211>   383
<212>   PRT
<213>   Zea mays

<400>   26
Pro Ile Ala Ile Arg Pro Thr Ser Glu Thr Val Met Tyr Pro Tyr Phe
 1   5   10   15

Ser Lys Trp Ile Arg Ser His Arg Asp Leu Pro Leu Arg Cys Asn Gln
                20   25   30

Trp Cys Asn Val Val Arg Trp Glu Phe Ser Asn Pro Thr Pro Phe Ile
            35   40   45

Arg Ser Arg Glu Phe Leu Trp Gln Glu Gly His Thr Ala Phe Ala Thr
        50   55   60

Lys Glu Glu Ala Asp Glu Glu Val Leu Gln Ile Leu Glu Leu Tyr Arg
65   70   75   80

Arg Ile Tyr Glu Glu Phe Leu Ala Val Pro Val Ser Lys Gly Arg Lys
                85   90   95

Ser Glu Met Glu Lys Phe Ala Gly Gly Leu Tyr Thr Thr Ser Val Glu
            100   105   110

Ala Phe Ile Pro Asn Thr Gly Arg Gly Ile Gln Gly Ala Thr Ser His
        115   120   125

Cys Leu Gly Gln Asn Phe Ala Lys Met Phe Asp Ile Thr Phe Glu Asn
    130   135   140

Glu Lys Gly Val Arg Glu Met Val Trp Gln Asn Ser Trp Ala Tyr Thr
145   150   155   160

19

```
Thr Arg Ser Ile Gly Val Met Val Met Thr His Gly Asp Asp Lys Gly
                165             170                 175

Leu Val Leu Pro Pro Lys Val Ala Pro Ile Gln Val Ile Val Ile Ser
            180             185                 190

Val Pro Tyr Lys Asp Ala Asp Thr Thr Ala Ile Lys Gly Ala Cys Glu
        195             200             205

Ser Thr Val Tyr Thr Leu Asp Gln Ser Gly Ile Arg Ala Asp Gln Asp
    210             215             220

Thr Arg Glu Asn Tyr Ser Pro Gly Trp Lys Tyr Ser His Trp Glu Met
225             230             235                 240

Lys Gly Val Pro Leu Arg Ile Glu Ile Gly Pro Lys Asp Leu Ala Asn
            245             250                 255

Lys Gln Val Arg Val Val Arg Arg Asp Asn Gly Ala Lys Val Asp Ile
            260             265             270

Pro Val Thr Asn Leu Val Glu Glu Val Lys Val Leu Leu Asp Glu Ile
        275             280             285

Gln Lys Asn Leu Phe Lys Thr Ala Gln Glu Lys Arg Asp Ala Cys Val
    290             295             300

His Val Val Asn Thr Trp Asp Glu Phe Thr Thr Ala Leu Asn Asn Lys
305             310             315                 320

Lys Leu Ile Leu Ala Pro Trp Cys Asp Glu Glu Glu Ile Glu Lys Asp
            325             330             335

Val Lys Thr Arg Thr Lys Gly Glu Leu Gly Ala Ala Lys Thr Leu Cys
            340             345             350

Thr Pro Phe Glu Gln Pro Glu Leu Pro Glu Gly Thr Leu Cys Phe Ala
        355             360             365

Ser Gly Lys Pro Ala Lys Lys Trp Ser Phe Trp Gly Arg Ser Tyr
    370             375             380

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<213>   Glycine max

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tcaggagtcg cgagtttctt tggcaagaag ggcacactgc ttttgcaaca aaggatgaag 180
canatgcaga agttcttgag attctggaat tatataggcg tatatacgaa gagtatttgg 240
cagttcctgt cataaagggt aagaanagtg agcttgagaa gtttgctggt ggactctaca 300
ctancaatgt tgaggcattt attccaaaca ctggtcgtgg tatccaaggt gcaacttctc 360
attgtttggg ccaaaatttt gctaaaatgt ttgagataaa ctttgaaaat gaaaagggag 420
agaaagcaat ggtctggcag aattcatggg cctatagtac tcgaactatt ggggtcatgg 480
tgatggttca tggtgatgac aangggattg gtactacctc ctaaagtagc atcagtacaa 540
gttattgtga ttcctgtgcc ttacaaagat gccgatactc aaggaatctt tgatgcctgt 600
ctgcactgtg aatacattga tgaagcagga tngcgctgag cagatctaga gatatatctc 660
ctggatgaga tccactggga atgaaagggt ctcnaga   697

<210>   28
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<212>   PRT
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21

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Glu Thr Val Met Tyr Pro Tyr Tyr Ser Lys Trp Ile Xaa Xaa His Arg
 1   5   10   15

Asp Leu Pro Leu Lys Leu Asn Gln Trp Cys Asn Val Val Xaa Trp Glu
                20   25   30

Phe Ser Asn Pro Thr Pro Xaa Ile Arg Ser Arg Glu Phe Leu Trp Gln
            35   40   45

Glu Gly His Thr Ala Phe Ala Thr Lys Asp Glu Ala Xaa Ala Glu Val
        50   55   60

Leu Glu Ile Leu Glu Leu Tyr Arg Arg Ile Tyr Glu Glu Tyr Leu Ala
65   70   75   80

Val Pro Val Ile Lys Gly Lys Xaa Ser Glu Leu Glu Lys Phe Ala Gly
                85   90   95

Gly Leu Tyr Thr Xaa Asn Val Glu Ala Phe Ile Pro Asn Thr Gly Arg
               100   105   110

Gly Ile Gln Gly Ala Thr Ser His Cys Leu Gly Gln Asn Phe Ala Lys
           115   120   125

Met Phe Glu Ile Asn Phe Glu Asn Glu Lys Gly Glu Lys Ala Met Val
       130   135   140

Trp Gln Asn Ser Trp Ala Tyr Ser Thr Arg Thr Ile Gly Val Met Val
145   150   155   160

Met Val His Gly Asp Asp Xaa Gly Ile Gly Thr Thr Ser
                165   170

<210>   29
<211>   564
<212>   DNA
<213>   Triticum aestivum

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ttttgcaact aaagaggagg cagatgaaga ggtcctccaa atattggaac tctacaggag 120
aatatatgaa gaatttttag cagttccagt gtccaaaggg aggaaaagtg agatggaaaa 180
gtttgctggt ggactttata caaccagtgt agaggccttc attccaaata ctggccgtgg 240
tatacaaggt gcaacttcac attgtcttgg tcaaaacttt gcaaagatgt ttgatatcac 300
tttcgagaat gaaaagggtg aacggtccat ggtgtggcag aactcttggg catacactac 360
ccgctcgatt ggggtcatga taatgacaca tggtgatgac aagggcttag tgctgccacc 420
aaaggtgacc tatccaggnc attgtatcct gtgccattaa agatgntgac acaacagcta 480
ttaaaggggc gtcgagcggc gttacacctt gaccaactgg atcggnagat ttgatnccgt 540
gaaatacccc caggtggaaa atcn   564

<210> 30
<211> 152
<212> PRT
<213> Triticum aestivum

<400> 30
Ser Asn Pro Thr Pro Phe Ile Arg Ser Arg Glu Phe Leu Trp Gln Glu
 1   5   10   15

Gly His Thr Val Phe Ala Thr Lys Glu Glu Ala Asp Glu Glu Val Leu
                20   25   30

Gln Ile Leu Glu Leu Tyr Arg Arg Ile Tyr Glu Glu Phe Leu Ala Val
            35   40   45

Pro Val Ser Lys Gly Arg Lys Ser Glu Met Glu Lys Phe Ala Gly Gly
        50   55   60

Leu Tyr Thr Thr Ser Val Glu Ala Phe Ile Pro Asn Thr Gly Arg Gly
65   70   75   80

Ile Gln Gly Ala Thr Ser His Cys Leu Gly Gln Asn Phe Ala Lys Met
                85   90   95

Phe Asp Ile Thr Phe Glu Asn Glu Lys Gly Glu Arg Ser Met Val Trp
            100   105   110

23

Gln Asn Ser Trp Ala Tyr Thr Thr Arg Ser Ile Gly Val Met Ile Met
        115   120   125

Thr His Gly Asp Asp Lys Gly Leu Val Leu Pro Pro Lys Val Thr Tyr
        130   135   140

Pro Gly His Cys Ile Leu Cys His
145   150

<210>   31
<211>   1072
<212>   PRT
<213>   Saccharomyces cerevisiae

<400>   31
Met Ser Glu Ser Asn Ala His Phe Ser Phe Pro Lys Glu Glu Glu Lys
  1   5   10   15

Val Leu Ser Leu Trp Asp Glu Ile Asp Ala Phe His Thr Ser Leu Glu
        20   25   30

Leu Thr Lys Asp Lys Pro Glu Phe Ser Phe Phe Asp Gly Pro Pro Phe
        35   40   45

Ala Thr Gly Thr Pro His Tyr Gly His Ile Leu Ala Ser Thr Ile Lys
    50   55   60

Asp Ile Val Pro Arg Tyr Ala Thr Met Thr Gly His His Val Glu Arg
 65   70   75   80

Arg Phe Gly Trp Asp Thr His Gly Val Pro Ile Glu His Ile Ile Asp
                85   90   95

Lys Lys Leu Gly Ile Thr Gly Lys Asp Asp Val Phe Lys Tyr Gly Leu
            100   105   110

Glu Asn Tyr Asn Asn Glu Cys Arg Ser Ile Val Met Thr Tyr Ala Ser
        115   120   125

Asp Trp Arg Lys Thr Ile Gly Arg Leu Gly Arg Trp Ile Asp Phe Asp
        130   135   140

Asn Asp Tyr Lys Thr Met Tyr Pro Ser Phe Met Glu Ser Thr Trp Trp
145   150   155   160

Ala Phe Lys Gln Leu His Glu Lys Gly Gln Val Tyr Arg Gly Phe Lys
            165   170   175

Val Met Pro Tyr Ser Thr Gly Leu Thr Thr Pro Leu Ser Asn Phe Glu
            180   185   190

Ala Gln Gln Asn Tyr Lys Asp Val Asn Asp Pro Ala Val Thr Ile Gly
        195   200   205

Phe Asn Val Ile Gly Gln Glu Lys Thr Gln Leu Val Ala Trp Thr Thr
    210   215   220

Thr Pro Trp Thr Leu Pro Ser Asn Leu Ser Leu Cys Val Asn Ala Asp
225   230   235   240

24

```
Phe Glu Tyr Val Lys Ile Tyr Asp Glu Thr Arg Asp Arg Tyr Phe Ile
              245               250               255

Leu Leu Glu Ser Leu Ile Lys Thr Leu Tyr Lys Lys Pro Lys Asn Glu
              260               265               270

Lys Tyr Lys Ile Val Glu Lys Ile Lys Gly Ser Asp Leu Val Gly Leu
          275               280               285

Lys Tyr Glu Pro Leu Phe Pro Tyr Phe Ala Glu Gln Phe His Glu Thr
    290               295               300

Ala Phe Arg Val Ile Ser Asp Asp Tyr Val Thr Ser Asp Ser Gly Thr
305               310               315               320

Gly Ile Val His Asn Ala Pro Ala Phe Gly Glu Glu Asp Asn Ala Ala
              325               330               335

Cys Leu Lys Asn Gly Val Ile Ser Glu Asp Ser Val Leu Pro Asn Ala
              340               345               350

Ile Asp Asp Leu Gly Arg Phe Thr Lys Asp Val Pro Asp Phe Glu Gly
          355               360               365

Val Tyr Val Lys Asp Ala Asp Lys Leu Ile Ile Lys Tyr Leu Thr Asn
    370               375               380

Thr Gly Asn Leu Leu Leu Ala Ser Gln Ile Arg His Ser Tyr Pro Phe
385               390               395               400

Cys Trp Arg Ser Asp Thr Pro Leu Leu Tyr Arg Ser Val Pro Ala Trp
              405               410               415

Phe Val Arg Val Lys Asn Ile Val Pro Gln Met Leu Asp Ser Val Met
          420               425               430

Lys Ser His Trp Val Pro Asn Thr Ile Lys Glu Lys Arg Phe Ala Asn
          435               440               445

Trp Ile Ala Asn Ala Arg Asp Trp Asn Val Ser Arg Asn Arg Tyr Trp
    450               455               460

Gly Thr Pro Ile Pro Leu Trp Val Ser Asp Asp Phe Glu Glu Val Val
465               470               475               480

Cys Val Gly Ser Ile Lys Glu Leu Glu Glu Leu Thr Gly Val Arg Asn
              485               490               495

Ile Thr Asp Leu His Arg Asp Val Ile Asp Lys Leu Thr Ile Pro Ser
              500               505               510

Lys Gln Gly Lys Gly Asp Leu Lys Arg Ile Glu Glu Val Phe Asp Cys
          515               520               525

Trp Phe Glu Ser Gly Ser Met Pro Tyr Ala Ser Gln His Tyr Pro Phe
    530               535               540

Glu Asn Thr Glu Lys Phe Asp Glu Arg Val Pro Ala Asn Phe Ile Ser
545               550               555               560
```

25

Glu Gly Leu Asp Gln Thr Arg Gly Trp Phe Tyr Thr Leu Ala Val Leu
              565   570   575

Gly Thr His Leu Phe Gly Ser Val Pro Tyr Lys Asn Val Ile Val Ser
              580   585   590

Gly Ile Val Leu Ala Ala Asp Gly Arg Lys Met Ser Lys Ser Leu Lys
              595   600   605

Asn Tyr Pro Asp Pro Ser Ile Val Leu Asn Lys Tyr Gly Ala Asp Ala
              610   615   620

Leu Arg Leu Tyr Leu Ile Asn Ser Pro Val Leu Lys Ala Glu Ser Leu
625   630   635   640

Lys Phe Lys Glu Glu Gly Val Lys Glu Val Val Ser Lys Val Leu Leu
              645   650   655

Pro Trp Trp Asn Ser Phe Lys Phe Leu Asp Gly Gln Ile Ala Leu Leu
              660   665   670

Lys Lys Met Ser Asn Ile Asp Phe Gln Tyr Asp Asp Ser Val Lys Ser
              675   680   685

Asp Asn Val Met Asp Arg Trp Ile Leu Ala Ser Met Gln Ser Leu Val
              690   695   700

Gln Phe Ile His Glu Glu Met Gly Gln Tyr Lys Leu Tyr Thr Val Val
705   710   715   720

Pro Lys Leu Leu Asn Phe Ile Asp Glu Leu Thr Asn Trp Tyr Ile Arg
              725   730   735

Phe Asn Arg Arg Arg Leu Lys Gly Glu Asn Gly Val Glu Asp Cys Leu
              740   745   750

Lys Ala Leu Asn Ser Leu Phe Asp Ala Leu Phe Thr Phe Val Arg Ala
              755   760   765

Met Ala Pro Phe Thr Pro Phe Leu Ser Glu Ser Ile Tyr Leu Arg Leu
770   775   780

Lys Glu Tyr Ile Pro Glu Ala Val Leu Ala Lys Tyr Gly Lys Asp Gly
785   790   795   800

Arg Ser Val His Phe Leu Ser Tyr Pro Val Val Lys Lys Glu Tyr Phe
              805   810   815

Asp Glu Ala Ile Glu Thr Ala Val Ser Arg Met Gln Ser Val Ile Asp
              820   825   830

Leu Gly Arg Asn Ile Arg Glu Lys Lys Thr Ile Ser Leu Lys Thr Pro
              835   840   845

Leu Lys Thr Leu Val Ile Leu His Ser Asp Glu Ser Tyr Leu Lys Asp
              850   855   860

Val Glu Ala Leu Lys Asn Tyr Ile Ile Glu Glu Leu Asn Val Arg Asp
865   870   875   880

26

```
Val Val Ile Thr Ser Asp Glu Ala Lys Tyr Gly Val Glu Tyr Lys Ala
            885                 890                 895

Val Ala Asp Trp Pro Val Leu Gly Lys Lys Leu Lys Lys Asp Ala Lys
            900                 905                 910

Lys Val Lys Asp Ala Leu Pro Ser Val Thr Ser Glu Gln Val Arg Glu
            915                 920                 925

Tyr Leu Glu Ser Gly Lys Leu Glu Val Ala Gly Ile Glu Leu Val Lys
            930                 935                 940

Gly Asp Leu Asn Ala Ile Arg Gly Leu Pro Glu Ser Ala Val Gln Ala
945                 950                 955                 960

Gly Gln Glu Thr Arg Thr Asp Gln Asp Val Leu Ile Ile Met Asp Thr
            965                 970                 975

Asn Ile Tyr Ser Glu Leu Lys Ser Glu Gly Leu Ala Arg Glu Leu Val
            980                 985                 990

Asn Arg Ile Gln Lys Leu Arg Lys Lys Cys Gly Leu Glu Ala Thr Asp
            995                 1000                1005

Asp Val Leu Val Glu Tyr Glu Leu Val Lys Asp Thr Ile Asp Phe Glu
    1010                1015                1020

Ala Ile Val Lys Glu His Phe Asp Met Leu Ser Lys Thr Cys Arg Ser
1025                1030                1035                1040

Asp Ile Ala Lys Tyr Asp Gly Ser Lys Thr Asp Pro Ile Gly Asp Glu
            1045                1050                1055

Glu Gln Ser Ile Asn Asp Thr Ile Phe Lys Leu Lys Val Phe Lys Leu
            1060                1065                1070

<210>   32
<211>   1266
<212>   PRT
<213>   Homo sapiens

<400>   32
Met Ser Asn Lys Met Leu Gln Gln Val Pro Glu Asn Ile Asn Phe Pro
  1             5                 10                  15

Ala Glu Glu Glu Lys Ile Leu Glu Phe Trp Thr Glu Phe Asn Cys Phe
            20                  25                  30

Gln Glu Cys Leu Lys Gln Ser Lys His Lys Pro Lys Phe Thr Phe Tyr
            35                  40                  45

Asp Gly Pro Pro Phe Ala Thr Gly Leu Pro His Tyr Gly His Ile Leu
    50                  55                  60

Ala Gly Thr Ile Lys Asp Ile Val Thr Arg Tyr Ala His Gln Ser Gly
65                  70                  75                  80

Phe His Val Asp Arg Arg Phe Gly Trp Asp Cys His Gly Leu Pro Val
            85                  90                  95
```

27

```
Glu Tyr Glu Ile Asp Lys Thr Leu Gly Ile Arg Gly Pro Glu Asp Val
            100                 105                 110

Ala Lys Met Gly Ile Thr Glu Tyr Asn Asn Gln Cys Arg Ala Ile Val
            115                 120                 125

Met Arg Tyr Ser Ala Glu Trp Lys Ser Thr Val Ser Arg Leu Gly Arg
    130                 135                 140

Trp Ile Asp Phe Asp Asn Asp Tyr Lys Thr Leu Tyr Pro Gln Phe Met
145             150                 155                     160

Glu Ser Val Trp Trp Val Phe Lys Gln Leu Tyr Asp Lys Gly Leu Val
                165                 170                 175

Tyr Arg Gly Val Lys Val Met Pro Phe Ser Thr Ala Cys Asn Thr Pro
            180                 185                 190

Leu Ser Asn Phe Glu Ser His Gln Asn Tyr Lys Asp Val Gln Asp Pro
            195                 200                 205

Ser Val Phe Val Thr Phe Pro Leu Glu Glu Asp Glu Thr Val Ser Leu
    210                 215                 220

Val Ala Trp Thr Thr Thr Pro Trp Thr Leu Pro Ser Asn Leu Ala Val
225             230                 235                     240

Cys Val Asn Pro Glu Met Gln Tyr Val Lys Ile Lys Asp Val Ala Arg
            245                 250                 255

Gly Arg Leu Leu Ile Leu Met Glu Ala Arg Leu Ser Ala Leu Tyr Lys
            260                 265                 270

Leu Glu Ser Asp Tyr Glu Ile Leu Glu Arg Phe Pro Gly Ala Tyr Leu
    275                 280                 285

Lys Gly Lys Lys Tyr Arg Pro Leu Phe Asp Tyr Phe Leu Lys Cys Lys
    290                 295                 300

Glu Asn Gly Ala Phe Thr Val Leu Val Asp Asn Tyr Val Lys Glu Glu
305             310                 315                     320

Glu Gly Thr Gly Val Val His Gln Ala Pro Tyr Phe Gly Ala Glu Asp
            325                 330                 335

Tyr Arg Val Cys Met Asp Phe Asn Ile Ile Arg Lys Asp Ser Leu Pro
            340                 345                 350

Val Cys Pro Val Asp Ala Ser Gly Cys Phe Thr Thr Glu Val Thr Asp
            355                 360                 365

Phe Ala Gly Gln Tyr Val Lys Asp Ala Asp Lys Ser Ile Ile Arg Thr
    370                 375                 380

Leu Lys Glu Gln Gly Arg Leu Leu Val Ala Thr Thr Phe Thr His Ser
385             390                 395                     400

Tyr Pro Phe Cys Trp Arg Ser Asp Thr Pro Leu Ile Tyr Lys Ala Val
            405                 410                 415
```

28

```
Pro Ser Trp Phe Val Arg Val Glu Asn Met Val Asp Gln Leu Leu Arg
        420                 425             430

Asn Asn Asp Leu Cys Tyr Trp Val Pro Glu Leu Val Arg Glu Lys Arg
        435                 440             445

Phe Gly Asn Trp Leu Lys Asp Ala Arg Asp Trp Thr Ile Ser Arg Asn
    450                 455             460

Arg Tyr Trp Gly Thr Pro Ile Pro Leu Trp Val Ser Asp Asp Phe Glu
465                 470             475                 480

Glu Val Val Cys Ile Gly Ser Val Ala Glu Leu Glu Glu Leu Ser Gly
            485                 490                 495

Ala Lys Ile Ser Asp Leu His Arg Glu Ser Val Asp His Leu Thr Ile
            500                 505             510

Pro Ser Arg Cys Gly Lys Gly Ser Leu His Arg Ile Ser Glu Val Phe
        515                 520             525

Asp Cys Trp Phe Glu Ser Gly Ser Met Pro Tyr Ala Gln Val His Tyr
    530                 535             540

Pro Phe Glu Asn Lys Arg Glu Phe Glu Asp Ala Phe Pro Ala Asp Phe
545                 550             555                 560

Ile Ala Glu Gly Ile Asp Gln Thr Arg Gly Trp Phe Tyr Thr Leu Leu
            565                 570             575

Val Leu Ala Thr Ala Leu Phe Gly Gln Pro Pro Phe Lys Asn Val Ile
        580             585             590

Val Asn Gly Leu Val Leu Ala Ser Asp Gly Gln Lys Met Ser Lys Arg
        595             600             605

Lys Lys Asn Tyr Pro Asp Pro Val Ser Ile Ile Gln Lys Tyr Gly Ala
    610             615             620

Asp Ala Leu Arg Leu Tyr Leu Ile Asn Ser Pro Val Val Arg Ala Glu
625             630             635                 640

Asn Leu Arg Phe Lys Glu Glu Gly Val Arg Asp Val Leu Lys Asp Val
            645             650             655

Leu Leu Pro Trp Tyr Asn Ala Tyr Arg Phe Leu Ile Gln Asn Val Leu
        660             665             670

Arg Leu Gln Lys Glu Glu Glu Ile Glu Phe Leu Tyr Asn Glu Asn Thr
        675             680             685

Val Arg Glu Ser Pro Asn Ile Thr Asp Arg Trp Ile Leu Ser Phe Met
    690             695             700

Gln Ser Leu Ile Gly Phe Phe Glu Thr Glu Met Ala Ala Tyr Arg Leu
705             710             715                 720

Tyr Thr Val Val Pro Arg Leu Val Lys Phe Val Asp Ile Leu Thr Asn
            725             730             735
```

29

```
Trp Tyr Val Arg Met Asn Arg Arg Arg Leu Lys Gly Glu Asn Gly Met
            740                 745             750

Glu Asp Cys Val Met Ala Leu Glu Thr Leu Phe Ser Val Leu Leu Ser
            755                 760             765

Leu Cys Arg Leu Met Ala Pro Tyr Thr Pro Phe Leu Thr Glu Leu Met
    770                 775             780

Tyr Gln Asn Leu Lys Val Leu Ile Asp Pro Val Ser Val Gln Asp Lys
785                 790             795             800

Asp Thr Leu Ser Ile His Tyr Leu Met Leu Pro Arg Val Arg Glu Glu
                805             810             815

Leu Ile Asp Lys Lys Thr Glu Ser Ala Val Ser Gln Met Gln Ser Val
            820             825             830

Ile Glu Leu Gly Arg Val Ile Arg Asp Arg Lys Thr Ile Pro Ile Lys
        835             840             845

Tyr Pro Leu Lys Glu Ile Val Val Ile His Gln Asp Pro Glu Ala Leu
    850             855             860

Lys Asp Ile Lys Ser Leu Glu Lys Tyr Ile Ile Glu Glu Leu Asn Val
865             870             875             880

Arg Lys Val Thr Leu Ser Thr Asp Lys Asn Lys Tyr Gly Ile Arg Leu
            885             890             895

Arg Ala Glu Pro Asp His Met Val Leu Gly Lys Arg Leu Lys Gly Ala
            900             905             910

Phe Lys Ala Val Met Thr Ser Ile Lys Gln Leu Ser Ser Glu Glu Leu
        915             920             925

Glu Gln Phe Gln Lys Thr Gly Thr Ile Val Val Glu Gly His Glu Leu
    930             935             940

His Asp Glu Asp Ile Arg Leu Met Tyr Thr Phe Asp Gln Ala Thr Gly
945             950             955             960

Gly Thr Ala Gln Phe Glu Ala His Ser Asp Ala Gln Ala Leu Val Leu
            965             970             975

Leu Asp Val Thr Pro Asp Gln Ser Met Val Asp Glu Gly Met Ala Arg
            980             985             990

Glu Val Ile Asn Arg Ile Gln Lys Leu Arg Lys Lys Cys Asn Leu Val
        995             1000            1005

Pro Thr Asp Glu Ile Thr Val Tyr Tyr Lys Ala Lys Ser Glu Gly Thr
    1010            1015            1020

Tyr Leu Asn Ser Val Ile Glu Ser His Thr Glu Phe Ile Phe Thr Thr
1025            1030            1035            1040

Ile Lys Ala Pro Leu Lys Pro Tyr Pro Val Ser Pro Ser Asp Lys Val
            1045            1050            1055
```

30

```
Leu Ile Gln Glu Lys Thr Gln Leu Lys Gly Ser Glu Leu Glu Ile Thr
         1060                1065                1070

Leu Thr Arg Gly Ser Ser Leu Pro Gly Pro Ala Cys Ala Tyr Val Asn
         1075                1080                1085

Leu Asn Ile Cys Ala Asn Gly Ser Glu Gln Gly Gly Val Leu Leu Leu
      1090                1095                1100

Glu Asn Pro Lys Gly Asp Asn Arg Leu Asp Leu Leu Lys Leu Lys Ser
1105                1110                1115                1120

Val Val Thr Ser Ile Phe Gly Val Lys Asn Thr Glu Leu Ala Val Phe
         1125                1130                1135

His Asp Glu Thr Glu Ile Gln Asn Gln Thr Asp Leu Leu Ser Leu Ser
         1140                1145                1150

Gly Lys Thr Leu Cys Val Thr Ala Gly Ser Ala Pro Ser Leu Ile Asn
         1155                1160                1165

Ser Ser Ser Thr Leu Leu Cys Gln Tyr Ile Asn Leu Gln Leu Leu Asn
      1170                1175                1180

Ala Lys Pro Gln Glu Cys Leu Met Gly Thr Val Gly Thr Leu Leu Leu
1185                1190                1195                1200

Glu Asn Pro Leu Gly Gln Asn Gly Leu Thr His Gln Gly Leu Leu Tyr
         1205                1210                1215

Glu Ala Ala Lys Val Phe Gly Leu Arg Ser Arg Lys Leu Lys Leu Phe
         1220                1225                1230

Leu Asn Glu Thr Gln Thr Gln Glu Ile Thr Glu Asp Ile Pro Val Lys
      1235                1240                1245

Thr Leu Asn Met Lys Thr Val Tyr Val Ser Val Leu Pro Thr Thr Ala
      1250                1255                1260

Asp Phe
1265


<210>   33
<211>   1262
<212>   PRT
<213>   Homo sapiens

<400>   33
Met Leu Gln Gln Val Pro Glu Asn Ile Asn Phe Pro Ala Glu Glu Glu
  1               5                10                15

Lys Ile Leu Glu Phe Trp Thr Glu Phe Asn Cys Phe Gln Glu Cys Leu
            20                25                30

Lys Gln Ser Lys His Lys Pro Lys Phe Thr Phe Tyr Asp Gly Pro Pro
         35                40                45

Phe Ala Thr Gly Leu Pro His Tyr Gly His Ile Leu Ala Gly Thr Ile
      50                55                60
```

31

```
Lys Asp Ile Val Thr Arg Tyr Ala His Gln Ser Gly Phe His Val Asp
65              70              75              80

Arg Arg Phe Gly Trp Asp Cys His Gly Leu Pro Val Glu Tyr Glu Ile
            85              90              95

Asp Lys Thr Leu Gly Ile Arg Gly Pro Glu Asp Val Ala Lys Met Gly
        100             105             110

Ile Thr Glu Tyr Asn Asn Gln Cys Arg Ala Ile Val Met Arg Tyr Ser
        115             120             125

Ala Glu Trp Lys Ser Thr Val Ser Arg Leu Gly Arg Trp Ile Asp Phe
        130             135             140

Asp Asn Asp Tyr Lys Thr Leu Tyr Pro Gln Phe Met Glu Ser Val Trp
145             150             155             160

Trp Val Phe Lys Gln Leu Tyr Asp Lys Gly Leu Val Tyr Arg Gly Val
            165             170             175

Lys Val Met Pro Phe Ser Thr Ala Cys Asn Thr Pro Leu Ser Asn Phe
            180             185             190

Glu Ser His Gln Asn Tyr Lys Asp Val Gln Asp Pro Ser Val Phe Val
        195             200             205

Thr Phe Pro Leu Glu Glu Asp Glu Thr Val Ser Leu Val Ala Trp Thr
        210             215             220

Thr Thr Pro Trp Thr Leu Pro Ser Asn Leu Ala Val Cys Val Asn Pro
225             230             235             240

Glu Met Gln Tyr Val Lys Ile Lys Asp Val Ala Arg Gly Arg Leu Leu
            245             250             255

Ile Leu Met Glu Ala Arg Leu Ser Ala Leu Tyr Lys Leu Glu Ser Asp
            260             265             270

Tyr Glu Ile Leu Glu Arg Phe Pro Gly Ala Tyr Leu Lys Gly Lys Lys
        275             280             285

Tyr Arg Pro Leu Phe Asp Tyr Phe Leu Lys Cys Lys Glu Asn Gly Ala
        290             295             300

Phe Thr Val Leu Val Asp Asn Tyr Val Lys Glu Glu Glu Gly Thr Gly
305             310             315             320

Val Val His Gln Ala Pro Tyr Phe Gly Ala Glu Asp Tyr Arg Val Cys
            325             330             335

Met Asp Phe Asn Ile Ile Arg Lys Asp Ser Leu Pro Val Cys Pro Val
            340             345             350

Asp Ala Ser Gly Cys Phe Thr Thr Glu Val Thr Asp Phe Ala Gly Gln
        355             360             365

Tyr Val Lys Asp Ala Asp Lys Ser Ile Ile Arg Thr Leu Lys Glu Gln
370             375             380
```

32

```
Gly Arg Leu Leu Val Ala Thr Thr Phe Thr His Ser Tyr Pro Phe Cys
385             390             395             400

Trp Arg Ser Asp Thr Pro Leu Ile Tyr Lys Ala Val Pro Ser Trp Phe
            405             410             415

Val Arg Val Glu Asn Met Val Asp Gln Leu Leu Arg Asn Asn Asp Leu
            420             425             430

Cys Tyr Trp Val Pro Glu Leu Val Arg Glu Lys Arg Phe Gly Asn Trp
            435             440             445

Leu Lys Asp Ala Arg Asp Trp Thr Ile Ser Arg Asn Arg Tyr Trp Gly
            450             455             460

Thr Pro Ile Pro Leu Trp Val Ser Asp Asp Phe Glu Glu Val Val Cys
465             470             475             480

Ile Gly Ser Val Ala Glu Leu Glu Glu Leu Ser Gly Ala Lys Ile Ser
            485             490             495

Asp Leu His Arg Glu Ser Val Asp His Leu Thr Ile Pro Ser Arg Cys
            500             505             510

Gly Lys Gly Ser Leu His Arg Ile Ser Glu Val Phe Asp Cys Trp Phe
            515             520             525

Glu Ser Gly Ser Met Pro Tyr Ala Gln Val His Tyr Pro Phe Glu Asn
            530             535             540

Lys Arg Glu Phe Glu Asp Ala Phe Pro Ala Asp Phe Ile Ala Glu Gly
545             550             555             560

Ile Asp Gln Thr Arg Gly Trp Phe Tyr Thr Leu Leu Val Leu Ala Thr
            565             570             575

Ala Leu Phe Gly Gln Pro Pro Phe Lys Asn Val Ile Val Asn Gly Leu
            580             585             590

Val Leu Ala Ser Asp Gly Gln Lys Met Ser Lys Arg Lys Lys Asn Tyr
            595             600             605

Pro Asp Pro Val Ser Ile Ile Gln Lys Tyr Gly Ala Asp Ala Leu Arg
            610             615             620

Leu Tyr Leu Ile Asn Ser Pro Val Val Arg Ala Glu Asn Leu Arg Phe
625             630             635             640

Lys Glu Glu Gly Val Arg Asp Val Leu Lys Asp Val Leu Leu Pro Trp
            645             650             655

Tyr Asn Ala Tyr Arg Phe Leu Ile Gln Asn Val Leu Arg Leu Gln Lys
            660             665             670

Glu Glu Glu Ile Glu Phe Leu Tyr Asn Glu Asn Thr Val Arg Glu Ser
            675             680             685

Pro Asn Ile Thr Asp Arg Trp Ile Leu Ser Phe Met Gln Ser Leu Ile
            690             695             700
```

33

Gly Phe Phe Glu Thr Glu Met Ala Ala Tyr Arg Leu Tyr Thr Val Val
705   710   715   720

Pro Arg Leu Val Lys Phe Val Asp Ile Leu Thr Asn Trp Tyr Val Arg
            725   730   735

Met Asn Arg Arg Arg Leu Lys Gly Glu Asn Gly Met Glu Asp Cys Val
            740   745   750

Met Ala Leu Glu Thr Leu Phe Ser Val Leu Leu Ser Leu Cys Arg Leu
            755   760   765

Ile Ala Pro Tyr Thr Pro Phe Leu Thr Glu Leu Met Tyr Gln Asn Leu
            770   775   780

Lys Val Leu Ile Asp Pro Val Ser Val Gln Asp Lys Asp Thr Leu Ser
785   790   795   800

Ile His Tyr Leu Met Leu Pro Arg Val Arg Glu Glu Leu Ile Asp Lys
            805   810   815

Lys Thr Glu Ser Ala Val Ser Gln Met Gln Ser Val Ile Glu Leu Gly
            820   825   830

Arg Val Ile Arg Asp Arg Lys Thr Ile Pro Ile Lys Tyr Pro Leu Lys
            835   840   845

Glu Ile Val Val Ile His Gln Asp Pro Glu Ala Leu Lys Asp Ile Lys
            850   855   860

Ser Leu Glu Lys Tyr Ile Ile Glu Glu Leu Asn Val Arg Lys Val Thr
865   870   875   880

Leu Ser Thr Asp Lys Asn Lys Tyr Gly Ile Arg Leu Arg Ala Glu Pro
            885   890   895

Asp His Met Val Leu Gly Lys Arg Leu Lys Gly Ala Phe Lys Ala Val
            900   905   910

Met Thr Ser Ile Lys Gln Leu Ser Ser Glu Glu Leu Glu Gln Phe Gln
            915   920   925

Lys Thr Gly Thr Ile Val Val Glu Gly His Glu Leu His Asp Glu Asp
            930   935   940

Ile Arg Leu Met Tyr Thr Phe Asp Gln Ala Thr Gly Gly Thr Ala Gln
945   950   955   960

Phe Glu Ala His Ser Asp Ala Gln Ala Leu Val Leu Leu Asp Val Thr
            965   970   975

Pro Asp Gln Ser Met Val Asp Glu Gly Met Ala Arg Glu Val Ile Asn
            980   985   990

Arg Ile Gln Lys Leu Arg Lys Lys Cys Asn Leu Val Pro Thr Asp Glu
            995   1000   1005

Ile Thr Val Tyr Tyr Lys Ala Lys Ser Glu Gly Thr Tyr Leu Asn Ser
    1010   1015   1020

34

```
Val Ile Glu Ser His Thr Glu Phe Ile Phe Thr Thr Ile Lys Ala Pro
1025               1030               1035               1040

Leu Lys Pro Tyr Pro Val Ser Pro Ser Asp Lys Val Leu Ile Gln Glu
               1045               1050               1055

Lys Thr Gln Leu Lys Gly Ser Glu Leu Glu Ile Thr Leu Thr Arg Gly
          1060               1065               1070

Ser Ser Leu Pro Gly Pro Ala Cys Ala Tyr Val Asn Leu Asn Ile Cys
          1075               1080               1085

Ala Asn Gly Ser Glu Gln Gly Gly Val Leu Leu Leu Glu Asn Pro Lys
     1090               1095               1100

Gly Asp Asn Arg Leu Asp Leu Leu Lys Leu Lys Ser Val Val Thr Ser
1105               1110               1115               1120

Ile Phe Gly Val Lys Asn Thr Glu Leu Ala Val Phe His Asp Glu Thr
               1125               1130               1135

Glu Ile Gln Asn Gln Thr Asp Leu Leu Ser Leu Ser Gly Lys Thr Leu
               1140               1145               1150

Cys Val Thr Ala Gly Ser Ala Pro Ser Leu Ile Asn Ser Ser Ser Thr
          1155               1160               1165

Leu Leu Cys Gln Tyr Ile Asn Leu Gln Leu Leu Asn Ala Lys Pro Gln
     1170               1175               1180

Glu Cys Leu Met Gly Thr Val Gly Thr Leu Leu Leu Glu Asn Pro Leu
1185               1190               1195               1200

Gly Gln Asn Gly Leu Thr His Gln Gly Leu Leu Tyr Glu Ala Ala Lys
               1205               1210               1215

Val Phe Gly Leu Arg Ser Arg Lys Leu Lys Leu Phe Leu Asn Glu Thr
               1220               1225               1230

Gln Thr Gln Glu Ile Thr Glu Asp Ile Pro Val Lys Thr Leu Asn Met
          1235               1240               1245

Lys Thr Val Tyr Val Ser Val Leu Pro Thr Thr Ala Asp Phe
     1250               1255               1260

<210>    34
<211>    626
<212>    PRT
<213>    Arabidopsis thaliana

<400>    34
Met Glu Gly Ala Ala Asp Gln Thr Thr Lys Ala Leu Ser Glu Leu Ala
 1                5                10                15

Met Asp Ser Ser Thr Thr Leu Asn Ala Ala Glu Ser Ser Ala Gly Asp
               20               25               30

Gly Ala Gly Pro Arg Ser Lys Asn Ala Leu Lys Lys Glu Gln Lys Met
          35               40               45
```

35

```
Lys Gln Lys Glu Glu Glu Lys Arg Arg Lys Asp Glu Glu Lys Ala Glu
     50                  55                  60

Lys Ala Lys Gln Ala Pro Lys Ala Ser Ser Gln Lys Ala Val Ala Ala
 65                  70                  75                  80

Asp Asp Glu Glu Met Asp Ala Thr Gln Tyr Tyr Glu Asn Arg Leu Lys
                 85                  90                  95

Tyr Leu Ala Ala Glu Lys Ala Lys Gly Glu Asn Pro Tyr Pro His Lys
             100                 105                 110

Phe Ala Val Ser Met Ser Ile Pro Lys Tyr Ile Glu Thr Tyr Gly Ser
             115                 120                 125

Leu Asn Asn Gly Asp His Val Glu Asn Ala Glu Glu Ser Leu Ala Gly
     130                 135                 140

Arg Ile Met Ser Lys Arg Ser Ser Ser Ser Lys Leu Phe Phe Tyr Asp
145                 150                 155                 160

Leu His Gly Asp Asp Phe Lys Val Gln Val Met Ala Asp Ala Ser Lys
             165                 170                 175

Ser Gly Leu Asp Glu Ala Glu Phe Leu Lys Leu His Ser Asn Ala Lys
             180                 185                 190

Arg Gly Asp Ile Val Gly Val Ile Gly Phe Pro Gly Lys Thr Lys Arg
             195                 200                 205

Gly Glu Leu Ser Ile Phe Pro Arg Ser Phe Ile Leu Leu Ser His Cys
     210                 215                 220

Leu His Met Met Pro Arg Lys Ala Asp Asn Val Asn Ala Lys Lys Pro
225                 230                 235                 240

Glu Ile Trp Val Pro Gly Gln Thr Arg Asn Pro Glu Ala Tyr Val Leu
             245                 250                 255

Lys Asp Gln Glu Ser Arg Tyr Arg Gln Arg His Leu Asp Met Ile Leu
             260                 265                 270

Asn Val Glu Val Arg Gln Ile Phe Arg Thr Arg Ala Lys Ile Ile Ser
     275                 280                 285

Tyr Val Arg Arg Phe Leu Asp Asn Lys Asn Phe Leu Glu Val Glu Thr
     290                 295                 300

Pro Met Met Asn Met Ile Ala Gly Gly Ala Ala Ala Arg Pro Phe Val
305                 310                 315                 320

Thr His His Asn Asp Leu Asp Met Arg Leu Tyr Met Arg Ile Ala Pro
             325                 330                 335

Glu Leu Tyr Leu Lys Gln Leu Ile Val Gly Gly Leu Glu Arg Val Tyr
             340                 345                 350

Glu Ile Gly Lys Gln Phe Arg Asn Glu Gly Ile Asp Leu Thr His Asn
     355                 360                 365
```

36

```
Pro Glu Phe Thr Thr Cys Glu Phe Tyr Met Ala Phe Ala Asp Tyr Asn
    370             375             380

Asp Leu Met Glu Met Thr Glu Val Met Leu Ser Gly Met Val Lys Glu
385             390             395                 400

Leu Thr Gly Gly Tyr Lys Ile Lys Tyr Asn Ala Asn Gly Tyr Asp Lys
                405             410             415

Asp Pro Ile Glu Ile Asp Phe Thr Pro Pro Phe Arg Arg Ile Glu Met
            420             425             430

Ile Gly Glu Leu Glu Lys Val Ala Lys Leu Asn Ile Pro Lys Asp Leu
        435             440             445

Ala Ser Glu Glu Ala Asn Lys Tyr Leu Ile Asp Ala Cys Ala Arg Phe
    450             455             460

Asp Val Lys Cys Pro Pro Pro Gln Thr Thr Ala Arg Leu Leu Asp Lys
465             470             475                 480

Leu Val Gly Glu Phe Leu Glu Pro Thr Cys Val Asn Pro Thr Phe Ile
            485             490             495

Ile Asn Gln Pro Glu Ile Met Ser Pro Leu Ala Lys Trp His Arg Ser
            500             505             510

Lys Ser Gly Leu Thr Glu Arg Phe Glu Leu Phe Ile Asn Lys His Glu
        515             520             525

Leu Cys Asn Ala Tyr Thr Glu Leu Asn Asp Pro Val Val Gln Arg Gln
    530             535             540

Arg Phe Ala Asp Gln Leu Lys Asp Arg Gln Ser Gly Asp Asp Glu Ala
545             550             555                 560

Met Ala Leu Asp Glu Thr Phe Cys Asn Ala Leu Glu Tyr Gly Leu Ala
            565             570             575

Pro Thr Gly Gly Trp Gly Leu Gly Ile Asp Arg Leu Ser Met Leu Leu
        580             585             590

Thr Asp Ser Leu Asn Ile Lys Glu Val Leu Phe Phe Pro Ala Met Arg
        595             600             605

Pro Pro Gln Glu Glu Ser Ala Ala Ala Gln Ala Pro Leu Thr Glu Glu
    610             615             620

Lys Lys
625

<210>   35
<211>   451
<212>   PRT
<213>   Homo sapiens

<400>   35
Met Val Gly Ser Ala Leu Arg Arg Gly Ala His Ala Tyr Val Tyr Leu
    1           5               10              15
```

37

```
Val Ser Lys Ala Ser His Ile Ser Arg Gly His Gln His Gln Ala Trp
        20                  25              30

Gly Ser Arg Pro Pro Ala Ala Glu Cys Ala Thr Gln Arg Ala Pro Gly
        35              40                  45

Ser Val Val Glu Leu Leu Gly Lys Ser Tyr Pro Gln Asp Asp His Ser
    50              55                  60

Asn Leu Thr Arg Lys Val Leu Thr Arg Val Gly Arg Asn Leu His Asn
65                  70              75                      80

Gln Gln His His Pro Leu Trp Leu Ile Lys Glu Arg Val Lys Glu His
            85                  90                  95

Phe Tyr Lys Gln Tyr Val Gly Arg Phe Gly Thr Pro Leu Phe Ser Val
            100             105             110

Tyr Asp Asn Leu Ser Pro Val Val Thr Thr Trp Gln Asn Phe Asp Ser
        115             120                 125

Leu Leu Ile Pro Ala Asp His Pro Ser Arg Lys Lys Gly Asp Asn Tyr
    130             135                 140

Tyr Leu Asn Arg Thr His Met Leu Arg Ala His Thr Ser Ala His Gln
145             150                 155                     160

Trp Asp Leu Leu His Ala Gly Leu Asp Ala Phe Leu Val Val Gly Asp
            165                 170                 175

Val Tyr Arg Arg Asp Gln Ile Asp Ser Gln His Tyr Pro Ile Phe His
        180                 185                 190

Gln Leu Glu Ala Val Arg Leu Phe Ser Lys His Glu Leu Phe Ala Gly
        195                 200                 205

Ile Lys Asp Gly Glu Ser Leu Gln Leu Phe Glu Gln Ser Ser Arg Ser
    210                 215                 220

Ala His Lys Gln Glu Thr His Thr Met Glu Ala Val Lys Leu Val Glu
225                 230                 235                 240

Phe Asp Leu Lys Gln Thr Leu Thr Arg Leu Met Ala His Leu Phe Gly
            245                 250                 255

Asp Glu Leu Glu Ile Arg Trp Val Asp Cys Tyr Phe Pro Phe Thr His
        260                 265                 270

Pro Ser Phe Glu Met Glu Ile Asn Phe His Gly Glu Trp Leu Glu Val
        275                 280                 285

Leu Gly Cys Gly Val Met Glu Gln Gln Leu Val Asn Ser Ala Gly Ala
    290                 295                 300

Gln Asp Arg Ile Gly Trp Ala Phe Gly Leu Gly Leu Glu Arg Leu Ala
305                 310                 315                 320

Met Ile Leu Tyr Asp Ile Pro Asp Ile Arg Leu Phe Trp Cys Glu Asp
            325                 330                 335
```

38

```
Glu Arg Phe Leu Lys Gln Phe Cys Val Ser Asn Ile Asn Gln Lys Val
            340             345             350

Lys Phe Gln Pro Leu Ser Lys Tyr Pro Ala Val Ile Asn Asp Ile Ser
            355             360             365

Phe Trp Leu Pro Ser Glu Asn Tyr Ala Glu Asn Asp Phe Tyr Asp Leu
    370             375             380

Val Arg Thr Ile Gly Gly Asp Leu Val Glu Lys Val Asp Leu Ile Asp
385             390             395             400

Lys Phe Val His Pro Lys Thr His Lys Thr Ser His Cys Tyr Arg Ile
                405             410             415

Thr Tyr Arg His Met Glu Arg Thr Leu Ser Gln Arg Glu Val Arg His
            420             425             430

Ile His Gln Ala Leu Gln Glu Ala Ala Val Gln Leu Leu Gly Val Glu
            435             440             445

Gly Arg Phe
    450

<210>   36
<211>   503
<212>   PRT
<213>   Saccharomyces cerevisiae

<400>   36
Met Ser Asp Phe Gln Leu Glu Ile Leu Lys Lys Leu Asp Glu Leu Asp
    1               5               10              15

Glu Ile Lys Ser Thr Leu Ala Thr Phe Pro Gln His Gly Ser Gln Asp
            20              25              30

Val Leu Ser Ala Leu Asn Ser Leu Lys Ala His Asn Lys Leu Glu Phe
            35              40              45

Ser Lys Val Asp Thr Val Thr Tyr Asp Leu Thr Lys Glu Gly Ala Gln
        50              55              60

Ile Leu Asn Glu Gly Ser Tyr Glu Ile Lys Leu Val Lys Leu Ile Gln
65              70              75              80

Glu Leu Gly Gln Leu Gln Ile Lys Asp Val Met Ser Lys Leu Gly Pro
            85              90              95

Gln Val Gly Lys Val Gly Gln Ala Arg Ala Phe Lys Asn Gly Trp Ile
            100             105             110

Ala Lys Asn Ala Ser Asn Glu Leu Glu Leu Ser Ala Lys Leu Gln Asn
            115             120             125

Thr Asp Leu Asn Glu Leu Thr Asp Glu Thr Gln Ser Ile Leu Ala Gln
    130             135             140

Ile Lys Asn Asn Ser His Leu Asp Ser Ile Asp Ala Lys Ile Leu Asn
145             150             155             160
```

39

```
Asp Leu Lys Lys Arg Lys Leu Ile Ala Gln Gly Lys Ile Thr Asp Phe
              165                 170                 175

Ser Val Thr Lys Gly Pro Glu Phe Ser Thr Asp Leu Thr Lys Leu Glu
              180                 185                 190

Thr Asp Leu Thr Ser Asp Met Val Ser Thr Asn Ala Tyr Lys Asp Leu
              195                 200                 205

Lys Phe Lys Pro Tyr Asn Phe Asn Ser Gln Gly Val Gln Ile Ser Ser
    210                 215                 220

Gly Ala Leu His Pro Leu Asn Lys Val Arg Glu Glu Phe Arg Gln Ile
225                 230                 235                 240

Phe Phe Ser Met Gly Phe Thr Glu Met Pro Ser Asn Gln Tyr Val Glu
              245                 250                 255

Thr Gly Phe Trp Asn Phe Asp Ala Leu Tyr Val Pro Gln Gln His Pro
              260                 265                 270

Ala Arg Asp Leu Gln Asp Thr Phe Tyr Ile Lys Asp Pro Leu Thr Ala
              275                 280                 285

Glu Leu Pro Asp Asp Lys Thr Tyr Met Asp Asn Ile Lys Ala Val His
    290                 295                 300

Glu Gln Gly Arg Phe Gly Ser Ile Gly Tyr Arg Tyr Asn Trp Lys Pro
305                 310                 315                 320

Glu Glu Cys Gln Lys Leu Val Leu Arg Thr His Ser Thr Ala Ile Ser
              325                 330                 335

Ala Arg Met Leu His Asp Leu Ala Lys Asp Pro Lys Pro Thr Arg Leu
              340                 345                 350

Phe Ser Ile Asp Arg Val Phe Arg Asn Glu Ala Val Asp Ala Thr His
              355                 360                 365

Leu Ala Glu Phe His Gln Val Glu Gly Val Leu Ala Asp Tyr Asn Ile
    370                 375                 380

Thr Leu Gly Asp Leu Ile Lys Phe Met Glu Glu Phe Phe Glu Arg Met
385                 390                 395                 400

Gly Val Thr Gly Leu Arg Phe Lys Pro Thr Tyr Asn Pro Tyr Thr Glu
              405                 410                 415

Pro Ser Met Glu Ile Phe Ser Trp His Glu Gly Leu Gln Lys Trp Val
              420                 425                 430

Glu Ile Gly Asn Ser Gly Met Phe Arg Pro Glu Met Leu Glu Ser Met
    435                 440                 445

Gly Leu Pro Lys Asp Leu Arg Val Leu Gly Trp Gly Leu Ser Leu Glu
    450                 455                 460

Arg Pro Thr Met Ile Lys Tyr Lys Val Gln Asn Ile Arg Glu Leu Leu
465                 470                 475                 480
```

40

```
Gly His Lys Val Ser Leu Asp Phe Ile Glu Thr Asn Pro Ala Ala Arg
              485                 490                 495

Leu Asp Glu Asp Leu Tyr Glu
              500
```

<210> 37
<211> 1440
<212> PRT
<213> Homo sapiens

<400> 37
```
Met Glu His Thr Glu Ile Asp His Trp Leu Glu Phe Ser Ala Thr Lys
 1                   5                  10                  15

Leu Ser Ser Cys Asp Ser Phe Thr Ser Thr Ile Asn Glu Leu Asn His
              20                  25                  30

Cys Leu Ser Leu Arg Thr Tyr Leu Val Gly Asn Ser Leu Ser Leu Ala
              35                  40                  45

Asp Leu Cys Val Trp Ala Thr Leu Lys Gly Asn Ala Ala Trp Gln Glu
        50                  55                  60

Gln Leu Lys Gln Lys Lys Ala Pro Val His Val Lys Arg Trp Phe Gly
 65                  70                  75                  80

Phe Leu Glu Ala Gln Gln Ala Phe Gln Ser Val Gly Thr Lys Trp Asp
                85                  90                  95

Val Ser Thr Thr Lys Ala Arg Val Ala Pro Glu Lys Lys Gln Asp Val
              100                 105                 110

Gly Lys Phe Val Glu Leu Pro Gly Ala Glu Met Gly Lys Val Thr Val
        115                 120                 125

Arg Phe Pro Pro Glu Ala Ser Gly Tyr Leu His Ile Gly His Ala Lys
    130                 135                 140

Ala Ala Leu Leu Asn Gln His Tyr Gln Val Asn Phe Lys Gly Lys Leu
145                 150                 155                 160

Ile Met Arg Phe Asp Asp Thr Asn Pro Glu Lys Glu Lys Glu Asp Phe
                165                 170                 175

Glu Lys Val Ile Leu Glu Asp Val Ala Met Leu His Ile Lys Pro Asp
                180                 185                 190

Gln Phe Thr Tyr Thr Ser Asp His Phe Glu Thr Ile Met Lys Tyr Ala
        195                 200                 205

Glu Lys Leu Ile Gln Glu Gly Lys Ala Tyr Val Asp Asp Thr Pro Ala
    210                 215                 220

Glu Gln Met Lys Ala Glu Arg Glu Gln Arg Ile Glu Ser Lys His Arg
225                 230                 235                 240

Lys Asn Pro Ile Glu Lys Asn Leu Gln Met Trp Glu Glu Met Lys Lys
              245                 250                 255
```

41

```
Gly Ser Gln Phe Gly His Ser Cys Cys Leu Arg Ala Lys Ile Asp Met
        260                 265                 270

Ser Ser Asn Asn Gly Cys Met Arg Asp Pro Thr Leu Tyr Arg Cys Lys
        275                 280                 285

Ile Gln Pro His Pro Arg Thr Gly Asn Lys Tyr Asn Val Tyr Pro Thr
        290                 295                 300

Tyr Asp Phe Ala Cys Pro Ile Val Asp Ser Ile Glu Gly Val Thr His
305                 310                 315                 320

Ala Leu Arg Thr Thr Glu Tyr His Asp Arg Asp Glu Gln Phe Tyr Trp
            325                 330                 335

Ile Ile Glu Ala Leu Gly Ile Arg Lys Pro Tyr Ile Trp Glu Tyr Ser
            340                 345                 350

Arg Leu Asn Leu Asn Asn Thr Val Leu Ser Lys Arg Lys Leu Thr Trp
        355                 360                 365

Phe Val Asn Glu Gly Leu Val Asp Gly Trp Asp Asp Pro Arg Phe Pro
    370                 375                 380

Thr Val Arg Gly Val Leu Arg Arg Gly Met Thr Val Glu Gly Leu Lys
385                 390                 395                 400

Gln Phe Ile Ala Ala Gln Gly Ser Ser Arg Ser Val Val Asn Met Glu
            405                 410                 415

Trp Asp Lys Ile Trp Ala Phe Asn Lys Lys Val Ile Asp Pro Val Ala
            420                 425                 430

Pro Arg Tyr Val Ala Leu Leu Lys Lys Glu Val Ile Pro Val Asn Val
        435                 440                 445

Pro Glu Ala Gln Glu Glu Met Lys Glu Val Ala Lys His Pro Lys Asn
    450                 455                 460

Pro Glu Val Gly Leu Lys Pro Val Trp Tyr Ser Pro Lys Val Phe Ile
465                 470                 475                 480

Glu Gly Ala Asp Ala Glu Thr Phe Ser Glu Gly Glu Met Val Thr Phe
            485                 490                 495

Ile Asn Trp Gly Asn Leu Asn Ile Thr Lys Ile His Lys Asn Ala Asp
            500                 505                 510

Gly Lys Ile Ile Ser Leu Asp Ala Lys Phe Asn Leu Glu Asn Lys Asp
        515                 520                 525

Tyr Lys Lys Thr Thr Lys Val Thr Trp Leu Ala Glu Thr Thr His Ala
    530                 535                 540

Leu Pro Ile Pro Val Ile Cys Val Thr Tyr Glu His Leu Ile Thr Lys
545                 550                 555                 560

Pro Val Leu Gly Lys Asp Glu Asp Phe Lys Gln Tyr Val Asn Lys Asn
            565                 570                 575

                                  42
```

```
Ser Lys His Glu Glu Leu Met Leu Gly Asp Pro Cys Leu Lys Asp Leu
        580             585             590

Lys Lys Gly Asp Ile Ile Gln Leu Gln Arg Arg Gly Phe Phe Ile Cys
        595             600             605

Asp Gln Pro Tyr Glu Pro Val Ser Pro Tyr Ser Cys Lys Glu Ala Pro
    610             615             620

Cys Val Leu Ile Tyr Ile Pro Asp Gly His Thr Lys Glu Met Pro Thr
625             630             635             640

Ser Gly Ser Lys Glu Lys Thr Lys Val Glu Ala Thr Lys Asn Glu Thr
            645             650             655

Ser Ala Pro Phe Lys Glu Arg Pro Thr Pro Ser Leu Asn Asn Asn Cys
            660             665             670

Thr Thr Ser Glu Asp Ser Leu Val Leu Tyr Asn Arg Val Ala Val Gln
            675             680             685

Gly Asp Val Val Arg Glu Leu Lys Ala Lys Lys Ala Pro Lys Glu Asp
    690             695             700

Val Asp Ala Ala Val Lys Gln Leu Leu Ser Leu Lys Ala Glu Tyr Lys
705             710             715             720

Glu Lys Thr Gly Gln Glu Tyr Lys Pro Gly Asn Pro Pro Ala Glu Ile
            725             730             735

Gly Gln Asn Ile Ser Ser Asn Ser Ser Ala Ser Ile Leu Glu Ser Lys
            740             745             750

Ser Leu Tyr Asp Glu Val Ala Ala Gln Gly Glu Val Val Arg Lys Leu
        755             760             765

Lys Ala Glu Lys Ser Pro Lys Ala Lys Ile Asn Glu Ala Val Glu Cys
    770             775             780

Leu Leu Ser Leu Lys Ala Gln Tyr Lys Glu Lys Thr Gly Lys Glu Tyr
785             790             795             800

Ile Pro Gly Gln Pro Pro Leu Ser Gln Ser Ser Asp Ser Ser Pro Thr
            805             810             815

Arg Asn Ser Glu Pro Ala Gly Leu Glu Thr Pro Glu Ala Lys Val Leu
            820             825             830

Phe Asp Lys Val Ala Ser Gln Gly Glu Val Val Arg Lys Leu Lys Thr
        835             840             845

Glu Lys Ala Pro Lys Asp Gln Val Asp Ile Ala Val Gln Glu Leu Leu
    850             855             860

Gln Leu Lys Ala Gln Tyr Lys Ser Leu Ile Gly Val Glu Tyr Lys Pro
865             870             875             880

Val Ser Ala Thr Gly Ala Glu Asp Lys Asp Lys Lys Lys Lys Glu Lys
            885             890             895
```

43

```
Glu Asn Lys Ser Glu Lys Gln Asn Lys Pro Gln Lys Gln Asn Asp Gly
              900                   905                   910

Gln Arg Lys Asp Pro Ser Lys Asn Gln Gly Gly Gly Leu Ser Ser Ser
              915                   920                   925

Gly Ala Gly Glu Gly Gln Gly Pro Lys Lys Gln Thr Arg Leu Gly Leu
        930                   935                   940

Glu Ala Lys Lys Glu Glu Asn Leu Ala Asp Trp Tyr Ser Gln Val Ile
945                   950                   955                   960

Thr Lys Ser Glu Met Ile Glu Tyr His Asp Ile Ser Gly Cys Tyr Ile
              965                   970                   975

Leu Arg Pro Trp Ala Tyr Ala Ile Trp Glu Ala Ile Lys Asp Phe Phe
              980                   985                   990

Asp Ala Glu Ile Lys Lys Leu Gly Val Glu Asn Cys Tyr Phe Pro Met
              995                   1000                  1005

Phe Val Ser Gln Ser Ala Leu Glu Lys Glu Lys Thr His Val Ala Asp
        1010                  1015                  1020

Phe Ala Pro Glu Val Ala Trp Val Thr Arg Ser Gly Lys Thr Glu Leu
1025                  1030                  1035                  1040

Ala Glu Pro Ile Ala Ile Arg Pro Thr Ser Glu Thr Val Met Tyr Pro
              1045                  1050                  1055

Ala Tyr Ala Lys Trp Val Gln Ser His Arg Asp Leu Pro Ile Lys Leu
              1060                  1065                  1070

Asn Gln Trp Cys Asn Val Val Arg Trp Glu Phe Lys His Pro Gln Pro
              1075                  1080                  1085

Phe Leu Arg Thr Arg Glu Phe Leu Trp Gln Glu Gly His Ser Ala Phe
        1090                  1095                  1100

Ala Thr Met Glu Glu Ala Ala Glu Glu Val Leu Gln Ile Leu Asp Leu
1105                  1110                  1115                  1120

Tyr Ala Gln Val Tyr Glu Glu Leu Leu Ala Ile Pro Val Val Lys Gly
              1125                  1130                  1135

Arg Lys Thr Glu Lys Glu Lys Phe Ala Gly Gly Asp Tyr Thr Thr Thr
              1140                  1145                  1150

Ile Glu Ala Phe Ile Ser Ala Ser Gly Arg Ala Ile Gln Gly Gly Thr
        1155                  1160                  1165

Ser His His Leu Gly Gln Asn Phe Ser Lys Met Phe Glu Ile Val Phe
        1170                  1175                  1180

Glu Asp Pro Lys Ile Pro Gly Glu Lys Gln Phe Ala Tyr Gln Asn Ser
1185                  1190                  1195                  1200

Trp Gly Leu Thr Thr Arg Thr Ile Gly Val Met Thr Met Val His Gly
              1205                  1210                  1215
```

44

```
Asp Asn Met Gly Leu Val Leu Pro Pro Arg Val Ala Cys Val Gln Val
          1220                1225                1230

Val Ile Ile Pro Cys Gly Ile Thr Asn Ala Leu Ser Glu Glu Asp Lys
          1235                1240                1245

Glu Ala Leu Ile Ala Lys Cys Asn Asp Tyr Arg Arg Arg Leu Leu Ser
     1250                1255                1260

Val Asn Ile Arg Val Arg Ala Asp Leu Arg Asp Asn Tyr Ser Pro Gly
1265                1270                1275                1280

Trp Lys Phe Asn His Trp Glu Leu Lys Gly Val Pro Ile Arg Leu Glu
               1285                1290                1295

Val Gly Pro Arg Asp Met Lys Ser Cys Gln Phe Val Ala Val Arg Arg
          1300                1305                1310

Asp Thr Gly Glu Lys Leu Thr Val Ala Glu Asn Glu Ala Glu Thr Lys
          1315                1320                1325

Leu Gln Ala Ile Leu Glu Asp Ile Gln Val Thr Leu Phe Thr Arg Ala
          1330                1335                1340

Ser Glu Asp Leu Lys Thr His Met Val Val Ala Asn Thr Met Glu Asp
1345                1350                1355                1360

Phe Gln Lys Ile Leu Asp Ser Gly Lys Ile Val Gln Ile Pro Phe Cys
               1365                1370                1375

Gly Glu Ile Asp Cys Glu Asp Trp Ile Lys Lys Thr Thr Ala Arg Asp
               1380                1385                1390

Gln Asp Leu Glu Pro Gly Ala Pro Ser Met Gly Ala Lys Ser Leu Cys
          1395                1400                1405

Ile Pro Phe Lys Pro Leu Cys Glu Leu Gln Pro Gly Ala Lys Cys Val
          1410                1415                1420

Cys Gly Lys Asn Pro Ala Lys Tyr Tyr Thr Leu Phe Gly Arg Ser Tyr
1425                1430                1435                1440
```